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THE ORIENTAL PEACH MOTH

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INTRODUCTORY

The oriental peach moth is a new and serious insect pest of peaches, quinces, and to a less extent certain other fruits. It is spreading rapidly and threatens to become an important insect problem in all peach-producing areas in the United States. This circular summarizes and presents in nontechnical language, so far as possible, the most important facts about the insect, in order that growers and others interested may have information at their disposal. Extensive and intensive studies on the insect are now in progress by investigators in the Bureau of Entomology and at several State agricultural experiment stations. It is hoped that in the near future some satisfactory method of control will be found.

NAMES

The scientific name of the oriental peach moth is *Laspeyresia molesta* Busck. The species belongs to the family Olethreutidae

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[1] For information on the brood periods and other matters of interest concerning the oriental peach moth in the several infested districts in the Eastern States, the authors are indebted to O. I. Snapp, C. H. Alden, and H. S. Swingle, of the Bureau of Entomology, who are investigating the insect in the Georgia peach belt; L. A. Stearns, of the New Jersey Agricultural Experiment Station, New Brunswick; P. A. Garman, of the Connecticut Agricultural Experiment Station, New Haven; S. A. Frost, of the Pennsylvania Agricultural Experiment Station, Arendtsville; and J. R. Stear, Chambersburg, and A. B. Champlain and H. B. Kirk, Harrisburg, all of the Pennsylvania Bureau of Plant Industry.

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(Eucosmidae) and the order Lepidoptera. The common name adopted in this publication is the "oriental peach moth." This insect has also been called "the oriental fruit moth," "the oriental fruit worm," "the codling moth of the peach," etc. The name "oriental peach moth" is chosen because it is the first common name given the insect in this country; furthermore, it is the name that most frequently appears in the literature. From the viewpoint of economic importance, it is primarily a peach pest.

INTRODUCTION AND DISTRIBUTION

The native home of this insect has not been determined. The oriental peach moth has been found in North America, Italy, Japan, and Australia, the earliest records of its occurrence coming from Japan and Australia (New South Wales). Entomologists in Japan report that the pest has been recently imported into their country, which therefore can hardly be its native home. In Japan it primarily attacks peaches and sand pears.

So far as known, the oriental peach moth was introduced into the United States from Japan about 1913. In this country it was first found attacking peach, plum, and cherry trees in the District of Columbia, Maryland, and Virginia. Since its establishment in North America it has spread rapidly and is now known to occur in Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Louisiana, Texas, Tennessee, Arkansas, Missouri, Ohio, and Ontario. Scouting records in 1923 and other sources of information indicate that infestations have occurred or may now be present in West Virginia, Indiana, Kentucky, Mississippi, and perhaps other States. The area of infestation now includes most of the peach-producing centers in the eastern part of the United States and Canada.

It is believed that the rapid and extensive spread of this insect has been due chiefly to shipments of infested fruit and nursery trees bearing overwintering larvæ in cocoons. The dispersal of infested fruit by means of automobiles and railroads undoubtedly has been a more important method of distribution than dispersal by means of infested nursery stock.

Spread by normal flight of the insect has been of a local character, and can not account for the long distances which occur between old and newly infested areas. After an infestation gets a start in a given locality the adults may fly from one orchard to another. Some have been recorded as flying one-fourth mile or more, but the maximum flight is unknown.

In scouting for newly infested areas it has been repeatedly noted that new infestations are commonly found on fruit trees, primarily peach, plum, cherry, and quince trees, located in back yards or home orchards in small and large towns. This fact strongly suggests that the source of the new infestations has been wormy fruit discarded by the housewife and merchant.

Occasionally nursery stock, particularly peach trees, will carry overwintering larvæ in cocoons. This, however, is not a common occurrence, because young trees have smooth bark and do not offer good protection for cocoons.

INTENSITY OF INFESTATION

In many of the areas where the oriental peach moth occurs the infestation is very light and scattered. On the other hand, in Connecticut, New Jersey, Pennsylvania, Maryland, Delaware, Virginia, and the District of Columbia moderate to heavy infestations occur. In some localities in these States late peaches and quinces have for several years had infestations running as high as 75 to 100 per cent wormy fruit. This is particularly true of some orchards in the southern half of New Jersey, southeastern Pennsylvania, and western Maryland.

Serious infestations in peaches have not as yet occurred in North Carolina, South Carolina, and Georgia, possibly because the pest has not been in the territory long enough to get a firm foothold, or because in the States just mentioned the greater part of the peach crop has been picked and shipped by July 15 to August 15. In most localities where peaches are grown no other fruit crop exists after these dates to an extent which might normally support the late broods. It has been shown by bureau investigators at Fort Valley that in Georgia there may be seven broods of larvæ, some of them partial, in one season. When the Elberta peach is ready for picking in Georgia the fourth-brood larvæ are most abundant and emerge as adults during the current season. Because the Elberta ripens at an early date in that section, a long period of time remains for the development of succeeding broods, the larvæ of which probably have difficulty in finding desirable and necessary food; as a consequence many of the larvae must perish and the total number is decreased materially. It is known that some of the larvæ of the fifth brood, a large portion of those of the sixth, and all of the seventh spin overwintering cocoons. These facts indicate that the long warm period after the last commercial peaches are picked brings about a situation detrimental to the production of a large dormant population of oriental peach-moth larvæ in southern orchards.

In New Jersey and near-by States, after the Elberta peach is picked, late peaches and other fruits furnish plenty of food for the development of a large number of overwintering larvæ. The Elberta peach is ready for picking late in August or early in September, and the larvæ of the third brood and a small portion of those of the fourth are present at this time. The late date at which the Elberta ripens here leaves but a brief time for the development of succeeding broods. This, however, does not interfere with the development of a large overwintering population, because many of the larvæ of the third brood, all or most of those of the fourth, and all of the fifth, when present, pass the winter in cocoons. This situation is conducive to the production of a large overwintering population in the mid-Atlantic States.

INJURY TO TWIGS

The larva, or worm, is the only stage in the life cycle of the insect which produces injury to plants. It will damage the twigs and fruit of most host plants. (See Table 1.)

Table 1.—*Relative degree of injury to twigs and fruit produced on commercial tree fruits by larvæ of the oriental peach moth*

Host	Injury to twigs [1]	Injury to fruits	Host	Injury to twigs [1]	Injury to fruits
Peach	Severe	Severe.	Cherry	Moderate	Rare.
Quince	Moderate (early)	Do.	Plum	Severe	Light.
Apricot	Moderate	Light.	Apple	Rare	Moderate.
Nectarine	do	Moderate.	Pear	do	Do.

[1] Twigs on flowering varieties of peach, cherry, and quince trees are also subject to attack.

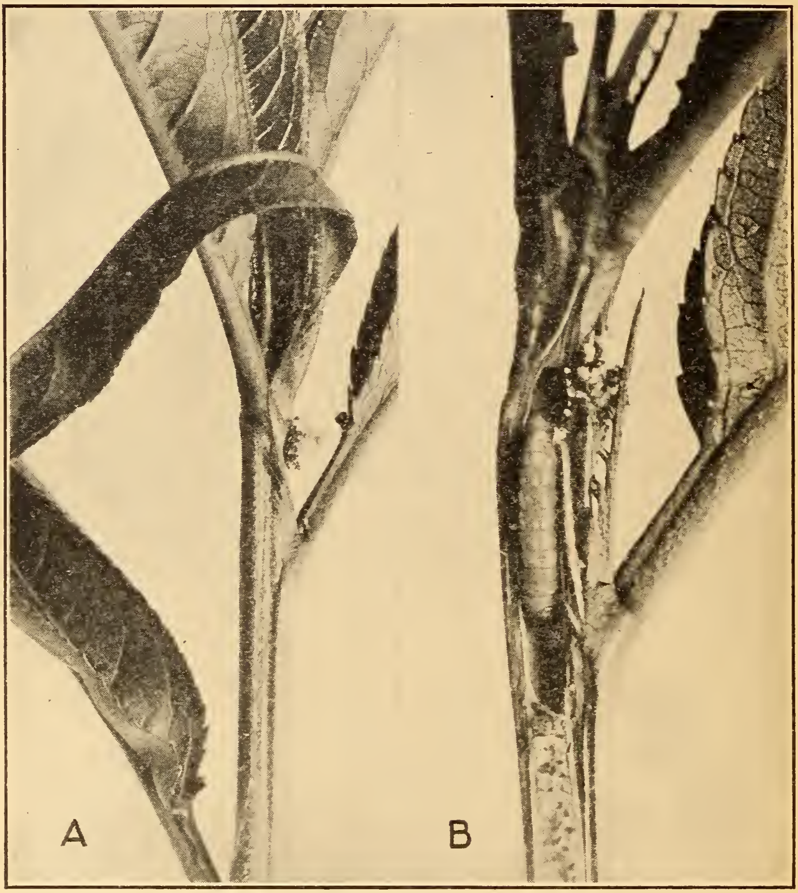

Fig. 1.—A, Newly infested peach twig, showing one wilted leaf and pile of frass where an oriental peach moth larva has entered; B, infested twig split open to show channel and larva within. Considerably enlarged

Tender growing peach twigs are exceedingly attractive to larvæ of the oriental peach moth (fig. 1). Plum and cherry twigs suffer at times from severe attacks of the larvæ. Quince twigs may show considerable injury early in the season, when they are tender, but their slow growth prevents extensive or severe injury.

A newly hatched larva, as a rule, enters the tender, growing twig at its tip near the base of a young leaf, whereas a half-grown larva, which has abandoned an old, injured twig for a new one, may enter at the axil of a new, fully developed leaf. This is especially true of peach twigs. Before a larva enters a twig it spins a frail and loose covering of silk threads about its body. When this is nearly completed it starts to gouge out particles of the green plant tissue by means of its biting mouth parts. The first mouthfuls are set to one side, where they become entangled in the silken threads about the larva. After the larva has its head deeply embedded within the plant it proceeds to consume the inner tissue. From this point on it continues to eat the central portion of the twig and gradually works its way down the shoot for 2 to 6 inches (fig. 2). When a twig is no longer desirable as food, the larva makes an exit hole somewhere along the gouged-out channel and emerges. If the larva needs more food to complete its development it may enter another twig or a fruit. One larva may enter several twigs, two to five, or even more. On emerging from a twig a full-grown larva will seek a place to spin a cocoon.

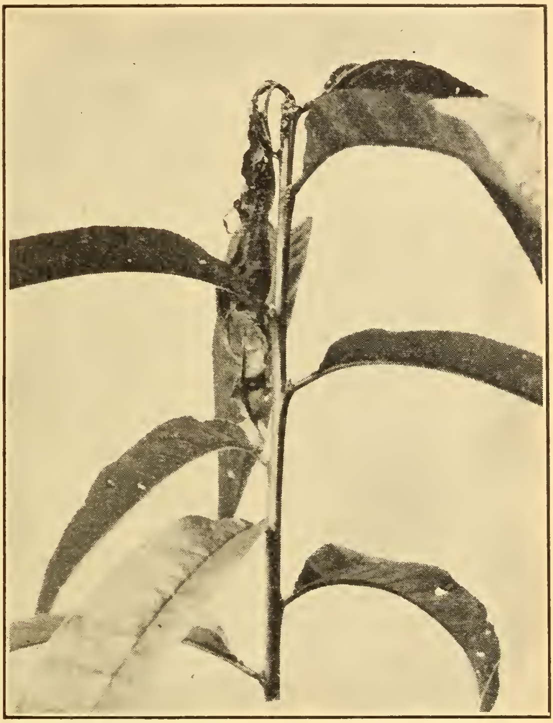

FIG. 2.—A peach twig that has been infested for several days by the oriental peach moth

Twigs infested by larvæ are green, as a rule, and usually have one or more wilted leaves. When an upright twig shows one small wilted leaf it means that a larva has recently entered it, probably 24 to 48 hours before the time of observation. As a larva progresses down into a twig successive leaves become wilted, the number depending upon the distance the larva penetrates. Injured twigs showing dark colored or dry leaves and exudations of gum no longer harbor larvæ.

Injury to peach twigs is not looked upon as serious by the average fruit grower. As a result of observations made over a period of years on new plantings of peaches, it is believed that severe injury to twigs for several successive years stunts growth to such a point that a 5-year-old tree is no larger than a normal 4-year-old tree should be. Two to four year old trees are most susceptible to attack. This is particularly true in well-kept orchards where vigorous growth of twigs and terminals on young trees occurs through most of the summer. It is not an uncommon sight to see young trees with 90 to 100 per cent of the twigs injured. If a new terminal is destroyed early in the season, several lateral shoots will appear below the injured terminal and grow rapidly. These may also be injured by later broods of larvæ. The production of secondary lateral shoots may result, in which case the tree growth resembles a bush. Careful pruning in the dormant season will partially remedy the situation.

INJURY TO FRUIT

The heaviest infestations of fruit by the larvæ of the oriental peach moth have been recorded for quinces. Six or more larvæ per fruit is a common occurrence, and 90 to 100 per cent of the crop of quinces may be infested. Late-ripening peaches are often heavily infested; one to six larvæ per fruit and an infestation of 75 to 90 per cent of the crop frequently occur. In seasons of heavy infestation 35 to 50 per cent of Elberta peaches may be injured. Early varieties of peaches usually escape serious injury. A 10 per cent injury of the Carman variety is high for the average season. As a general rule, the later the date of ripening of a peach the greater the chance for a heavy infestation.

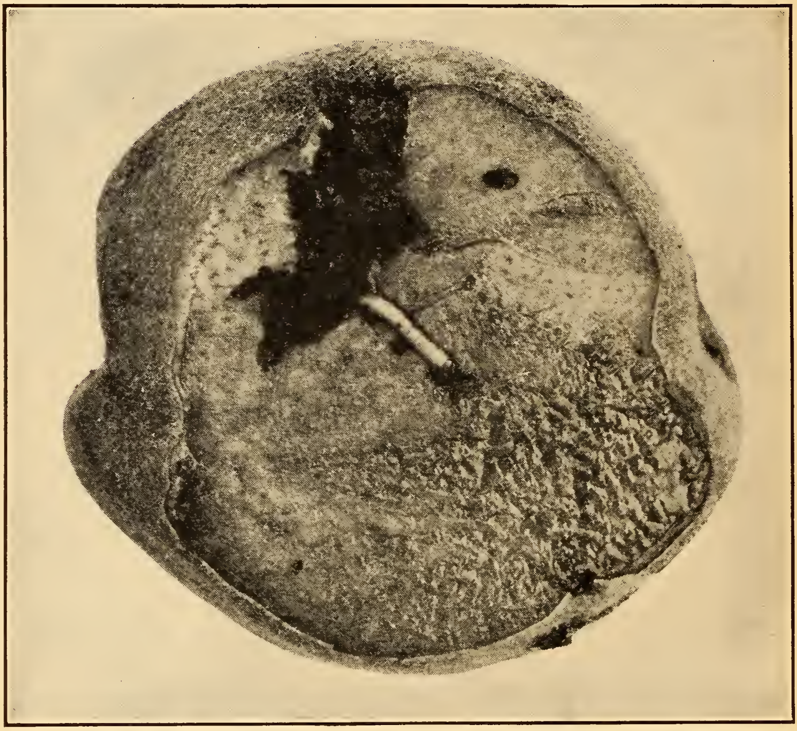

FIG. 3.—Work of oriental peach moth larva within a peach. Enlarged

Factors other than the date of ripening influence the degree of infestation, particularly in the case of early varieties. In New Jersey, if dry weather exists late in June and during July and causes the twigs to stop growing and begin to harden, the partly grown larvæ will come out of the twigs and go to the growing fruit; the newly hatched larvæ will also find the twigs undesirable and will do likewise. The larvæ that leave the twigs and go to the fruit produce the side-entrance injury. Moderate to fairly heavy infestations have occurred in early varieties when these weather conditions existed.

The amount of fruit on the tree seems to have some bearing on the percentage of injury. Counts made of the infestation of trees of a given variety in the same orchard show that a tree with a light crop usually has a higher percentage of infestation than a tree with a heavy crop. Parasitism and other natural factors influence the degree of fruit infestation.

The injury to fruit on a given tree increases as the fruit ripens. Usually infested fruit ripens prematurely, and some may drop. In making counts of infested fruit the first picking usually shows the heaviest infestation. Occasionally larvæ will enter small peaches, having a diameter of one-half to 1 inch, but as a rule they enter fruit that is two-thirds to full grown and almost ripe. Once a larva is within the fruit it may make a long, irregular channel through the soft tissue (fig. 3) or confine its activity to a small area. Newly hatched larvæ that enter the stem end do their first feeding near the stem and about the pit. This probably explains the fact that many of the infested peaches drop when they become ripe. So far as known, a larva will not attack more than one fruit, and will not abandon a fruit for a twig. When a larva has completed its development in a peach (fig. 4) it eats its way to the surface and makes a round exit hole.

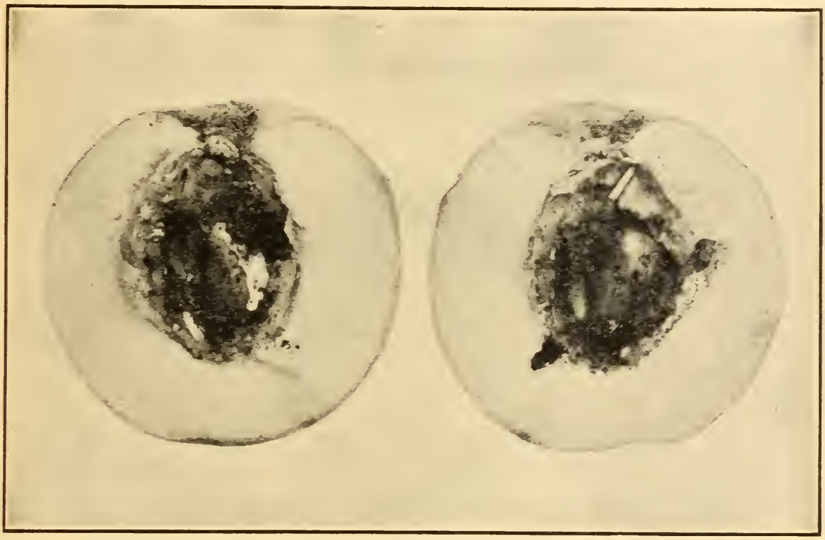

FIG. 4.—An infested peach, split open to show oriental peach moth larva and injury

The points of entrance suggest types of external injury produced by larvæ entering peaches, and entrances may accordingly be classified more or less sharply into three groups, namely, side entrance, stem entrance, and invisible entrance.

Injury caused by entrance into the side of the fruit, sometimes called "old injury," usually takes place early in the season. It is usually caused by larvæ that have abandoned the twigs and have gone to the fruit. It may take place where two peaches are in contact (fig. 5), where a leaf rests against a peach (fig. 6), or on the open surface of the fruit. As the peach grows, gum exudes from the point of entrance. The exudations turn dark as the season progresses, and a distinct blotch will be present on the peach at picking time. The infested fruit of early varieties usually shows a high percentage of side entrance; other types of entrance are not so common.

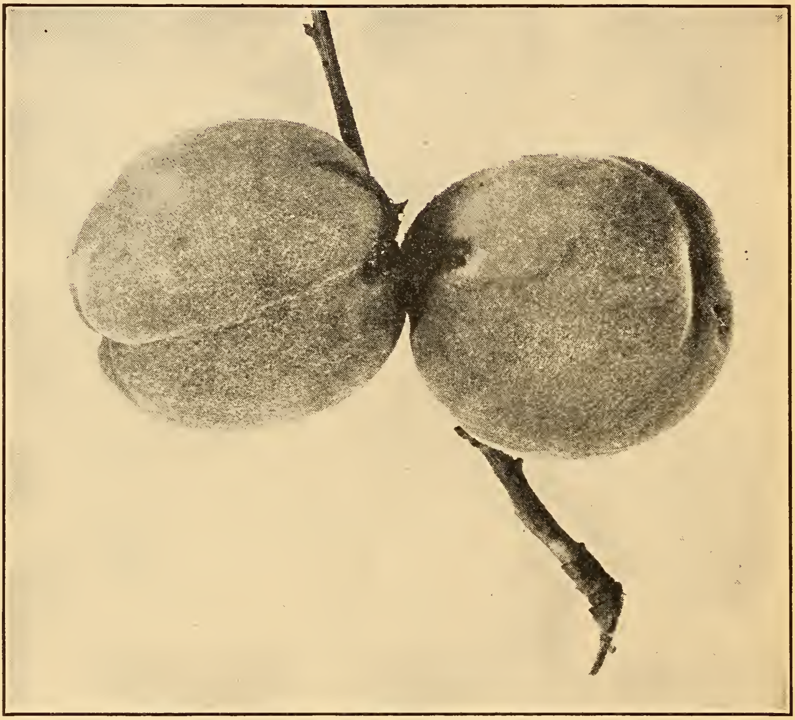

FIG. 5.—Side entrance of oriental peach moth larva where two peaches are in contact

Injury caused by entrance at the stem, sometimes called "new injury," occurs when the fruit is almost full-grown, especially in late varieties. This injury is due to newly hatched larvæ which go directly from the egg to the fruit. As a larva wanders over twigs and leaves in search of food the first part of the peach it reaches is apt to be tissue near the stem end. The outside skin surrounding the stem is tender and the larva promptly enters at this point (fig. 7). In doing so it leaves a small pile of frass, which is easily overlooked unless the fruit is examined carefully. In sorting fruit in packing sheds this type of injury is not seen unless it is very prominent. Stem entrance in late varieties may run as high as 50 per cent or more of the entire infestation. Generally speaking, the later the

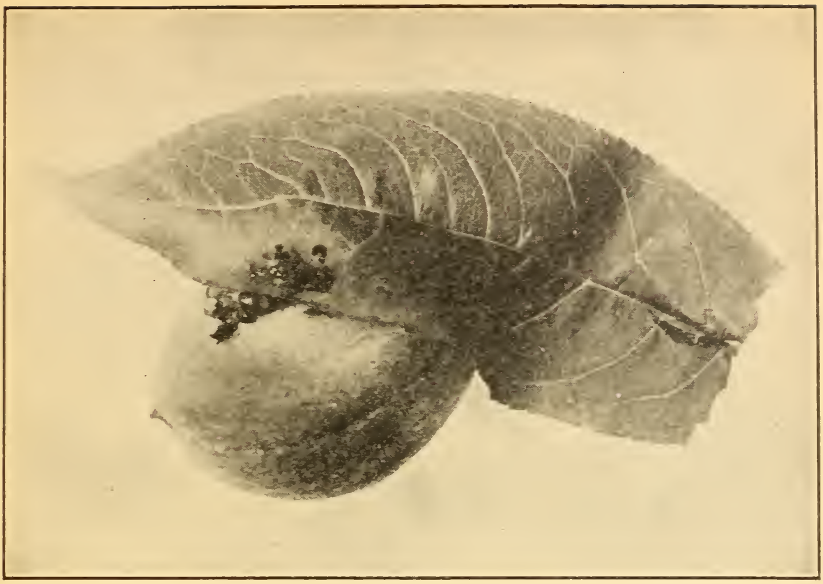

FIG. 6.—Side entrance of oriental peach moth larva where a leaf is in contact with a peach

variety of peach the greater the percentage of stem entrance and the smaller that of side entrance.

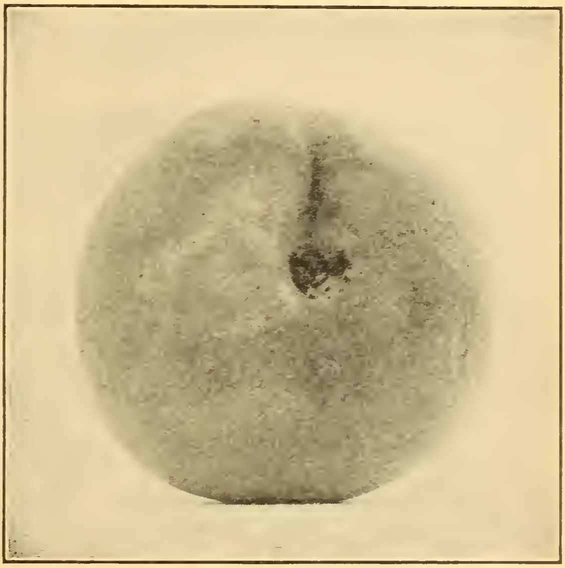

FIG. 7.—Full-grown peach, with entrance of oriental peach moth larva at the stem. Note the pile of frass to the right of the entrance

A type of injury characterized by no visible entrance is found in late peaches, and may run as high as 20 to 35 per cent of the infestation. It is a common experience to examine a peach with great care and find no external sign of injury, yet when the peach is cut open a larva is found feeding on the inside tissue. The larva under these conditions entered the fruit through the green stem. In the orchard it has been repeatedly noted that a newly hatched larva may enter the side of the stem and from this point works its way down through the short stem into the fruit without in any way injuring the external skin. When the peach is picked the short

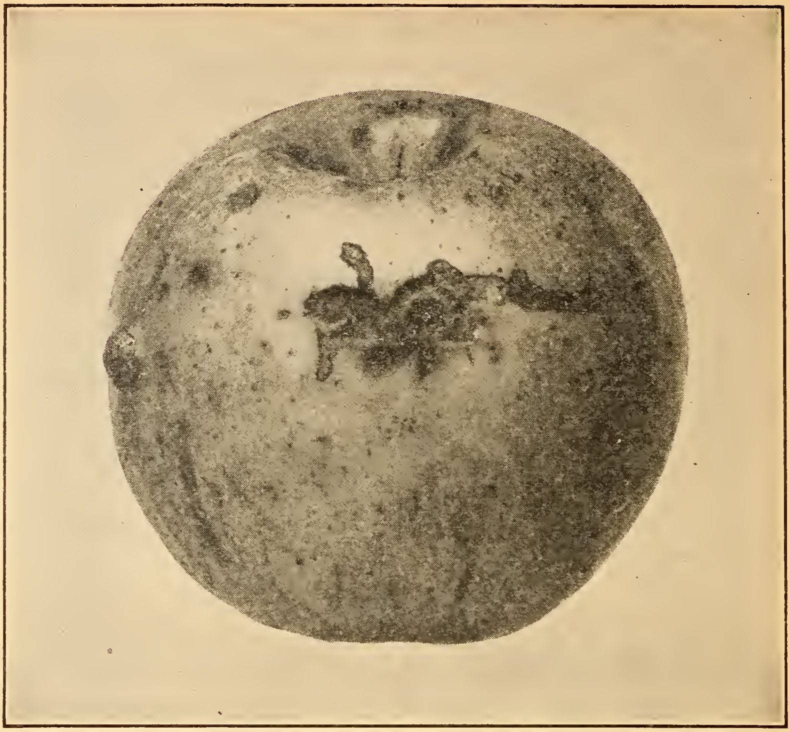

FIG. 8.—Entrance point and work of oriental peach moth larva underneath skin of an apple

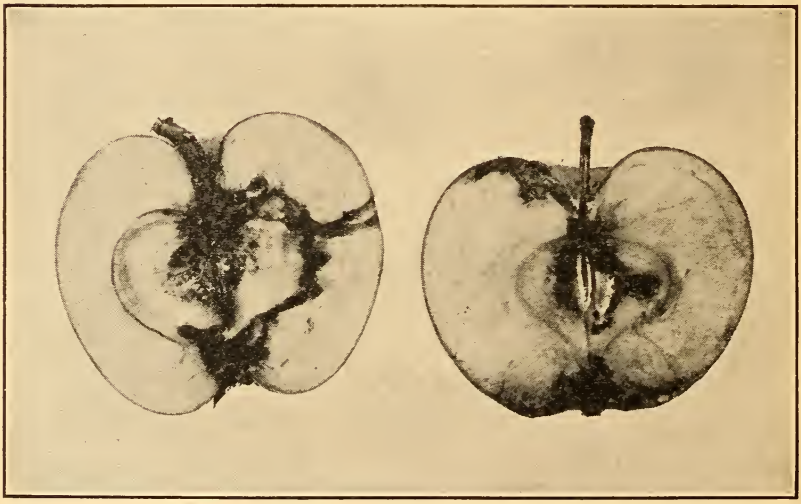

FIG. 9.—An apple infested by the oriental peach moth, split open to show injury

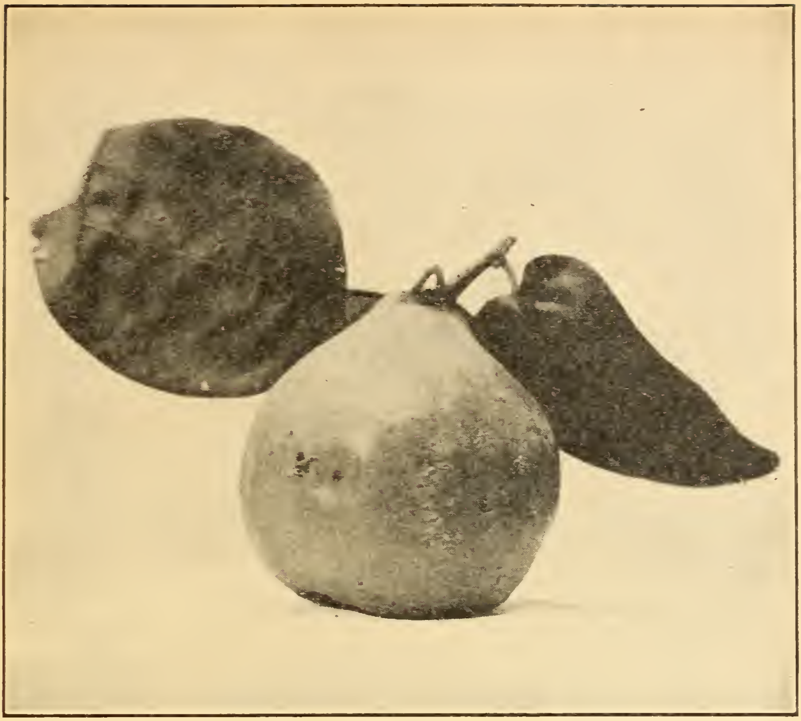

Fig. 10.—A quince infested by the oriental peach moth, showing exit holes

stem remains on the tree, and all evidence is destroyed as to how the larva obtained entrance. So far as known, invisible entrance is produced by newly hatched larvæ, and not by larvæ that have abandoned the twigs for the fruit.

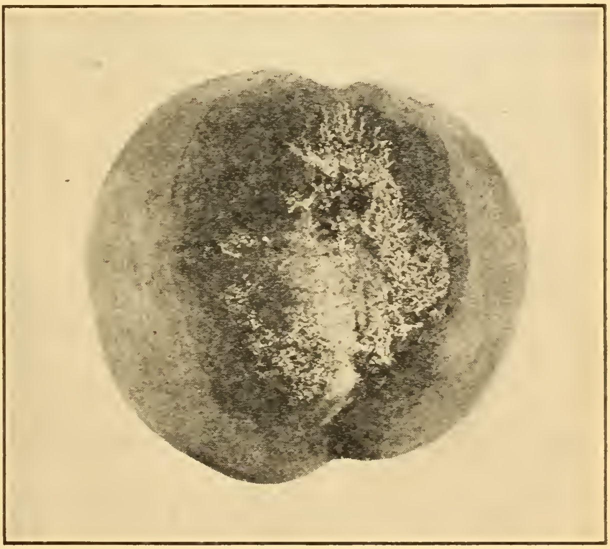

Fig. 11.—Brown-rot infestation about exit hole of oriental peach moth larva on full-grown peach

The infestation of oriental peach moth larvæ in fruits other than peaches and quinces is usually small. An infestation as high as 50 per cent has been recorded for apples, and occurred under most favorable conditions, a block of Stayman Winesap apples being interplanted with late peaches that were heavily infested. In another instance, where Stayman Winesap apples were adjacent to a block of heavily infested late peaches, the apples showed a 35 per cent infestation.

The type of injury produced by the larva of the oriental peach moth on apples and pears is similar to the injury produced by the larva of the codling moth. If a newly hatched larva enters the side of the apple it may make an irregular channel immediately below the skin before it penetrates the fruit deeply (fig. 8). The entrance point of a larva on an apple is usually near or adjacent to the stem (fig. 9), whereas the entrance point on quince is usually below or near the calyx lobes, or at the stem end. The larva may also enter the stem end or side of the quince (fig. 10).

Infested peaches, particularly late varieties, are frequently infected with brown-rot. The infection usually begins near the entrance or exit holes of larvæ (fig. 11).

THE ORIENTAL PEACH MOTH AND THE CODLING MOTH

The oriental peach moth resembles the well-known codling moth in many respects, as shown in Table 2.

TABLE 2.—*A comparison between the oriental peach moth and the codling moth*

Subject	Oriental peach moth	Codling moth
Scientific name	Laspeyresia molesta Busck	Carpocapsa pomonella L.
Source	Japan	Europe.
Date imported	About 1913	Before 1750.
Distribution	Eastern part of the United States	In all apple sections of the United States.
Food plants	Peach, quince, apple, pear, plum, apricot, cherry, nectarine, etc.	Apple, pear, quince, plum, cherry, peach, English walnut, etc.
Portion injured	Twigs and fruit	Fruit (and leaves, to a small extent).
Broods per season in New Jersey.	Four or five	Two or three.
Egg	Glistening white, disklike, circular to oval in outline.	Glistening white, disklike, circular to oval in outline.
	Diameter about 0.7 mm	Diameter about 1.1 mm.
	Incubation period during summer 3½ to 6 days.	Incubation period during summer 5 to 9 days.
	Located on under surface of peach foliage, on upper surface of quince and apple foliage.	Located on upper and under surfaces of apple and pear foliage.
Larva	Young larva white with black head and black thoracic and anal shields.	Young larva white with black head and black thoracic and anal shields.
	Full-grown larva usually pink with brown head and brown thoracic and anal shields; size ½ inch.	Full-grown larva usually red with brown head and brown thoracic and anal shields; size ¾ inch.
	Anal fork on last segment	No anal fork.
	Summer larvæ require 6 to 15 days to develop.	Summer larvæ require 17 to 33 days to develop.
Cocoon (larva and pupa)	Made of silk and bits of the object on which it rests.	Made of silk and particles of the concealing object.
	Length about ½ inch	Length about ¾ inch.
	Width about ⅛ inch	Width about ¼ inch.
	Summer cocoons fragile and located on fruit and twigs and in other places; winter cocoons firmly constructed and located on tree under or on bark and also on trash on ground.	Summer cocoons and firmly constructed winter cocoons usually located under bark or in trash on the ground.
	Cocoon period (summer) usually 12 to 15 days.	Cocoon period (summer) usually 10 to 14 days.
Adult	Small grayish-brown moth; wing span ½ inch.	Grayish-brown moth with dark bronze spots near tip end of fore wings; wing span ¾ inch.
	Spring-brood adults begin to emerge at peach blossom time, and continue to appear for 7 to 9 weeks. Last adults emerge late in September or in October (in New Jersey). Adults live 5 to 15 days in summer. They are most active about sunset. Females deposit 100 to 200 eggs.	Spring-brood adults appear 7 to 14 days after apples bolssom, and continue to emerge for 6 to 8 weeks. Last adults emerge late in August or early in September. Adults live 3 to 12 days in summer. They are most active about sunset. Females deposits 75 to 150 or more eggs.

LIFE HISTORY AND HABITS

Some of the more important facts relative to the life cycle of the oriental peach moth have been determined by entomologists at several field stations in the eastern part of the United States.

In all localities, so far as known, the insect passes the winter as a full-grown larva in a cocoon. Early in the spring the larva changes to a pupa. In New Jersey some of the larvæ may make this change as early as the last week in February. By the end of March or early in April most of the larvæ have changed to pupæ. The pupal stage lasts for three weeks or longer, and about the time peaches are in full blossom the first spring-brood adults begin to emerge. The emergence period of this brood continues for eight to nine weeks in New Jersey. In Figure 12 it will be noted that there is a distinct overlapping of the spring brood and the first brood of adults. As the season progresses the overlapping of broods becomes greater. At Riverton, N. J., in 1925, this overlapping reached the points where three broods of adults (second, third, and fourth) were alive at one time, September 5 to 20. The daily adult emergence is represented by the height of the perpendicular lines. By means of the triangles at the top, the figure shows the duration of each brood (base line), the average daily emergence (height), and the date when 50 per cent of the adults of each brood had emerged (location of the peak).

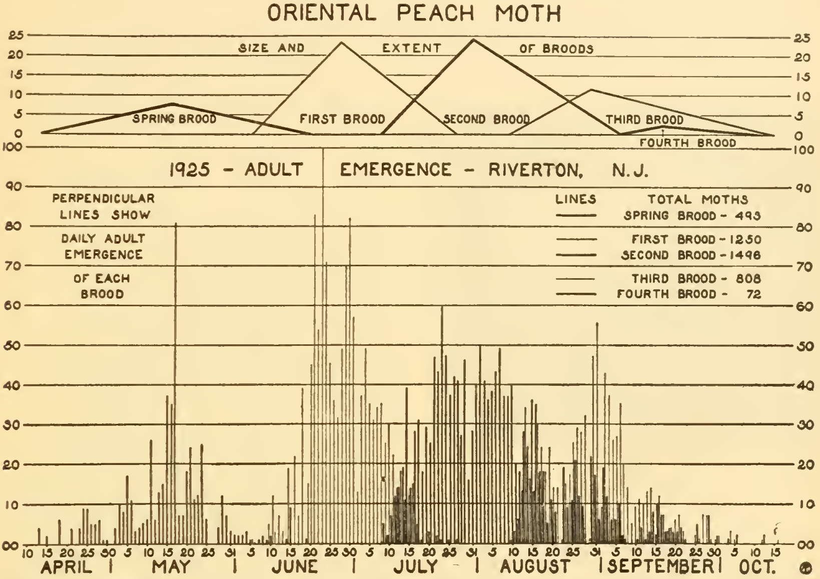

FIG. 12.—Emergence of oriental peach moths in insectary at Riverton, N. J., in 1925. The perpendicular lines indicate the daily adult emergence of each brood. The triangles at the top show the number, duration, size, and overlapping of the broods

There are four stages in the life cycle of the oriental peach moth; egg, larva (worm), pupa (in cocoon), and adult (moth). Each stage will be considered separately.

THE EGG

The egg (fig. 13) is a grayish-white, slightly convex, round or slightly oval, disk-like object measuring about 0.7 millimeter (one-thirty-fifth inch) across. In peach orchards most of the eggs are found on the under surfaces of leaves, two-thirds grown to full-grown, near the terminal ends of the growing twigs. This is particularly true in the case of young trees. Occasionally eggs may be deposited on the smooth, green twigs. In quince and apple orchards the eggs are placed on the smooth upper surfaces of the leaves. The texture of the surface on which the eggs are deposited seems to be important. When adults are placed inside of smooth glass jars (6 by 8 inches) containing apple or peach foliage, most of the eggs will be deposited on the smooth glass rather than on the leaves.

The incubation period of the egg is largely dependent upon temperature. Records made in New Jersey show variations in this period of 3½ to 43 days. In the summer, when warm weather is more or less continuous, the eggs hatch in 3½ to 6 days, whereas early in the spring the first eggs deposited by the first adults of the spring brood require from 7 to 14 days to hatch. Late in the fall (October and November), when cool weather is almost continuous, the incubation period may be from 20 to 43 days.

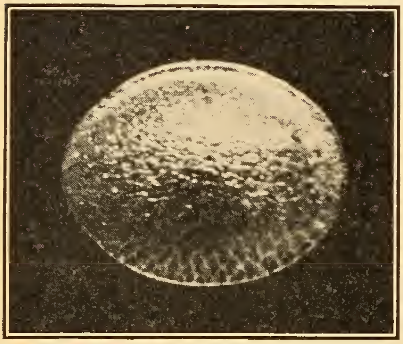

FIG. 13.—Egg of oriental peach moth, greatly enlarged

A few hours previous to hatching the newly formed larva can be seen inside the eggshell. Its head is black, and to the naked eye the egg shows a dark spot near the center. When summer temperatures prevail, the black spot appears 18 to 48 hours before hatching. In case the incubation period of the egg is three and one-half days, the black spot appears about 18 hours before the larva emerges. The mortality in normal fertilized eggs which are not parasitized is very low, being about 2 to 5 per cent.

THE LARVA

Oriental peach moth larvæ range in length from 1.5 to approximately 12 millimeters (fig. 14). All larval instars possess biting mouth parts, three pairs of true jointed legs, located on the thoracic segments, and five pairs of fleshy false legs (prolegs), located on the ventral aspects of the third, fourth, fifth, sixth, and last abdominal segments. As far as known, the larva in its development casts its skin three times; consequently there are three larval instars. The first molt occurs when the larva is 3 or 4 millimeters long, the second when the length is 6 or 7 millimeters, and the last when the full-grown larva, 10 or 12 millimeters (about one-half inch) long, changes to a pupa. The first and second larval instars are white, with a black head and dark colored thoracic and anal shields; the third and last is at first a dirty white or gray, but as the larva increases in size it gradually becomes pink, or almost red. It has been noted that mature larvæ which have fed on peach tissue are more apt to be red (or pink) than larvæ which have fed on apples or quinces. The head and the thoracic and anal shields of the third instar are brown. A small chitinized anal fork is present on the ventral aspect of the last abdominal segment caudad of the anal opening, and is most prominent on the third larval instar.

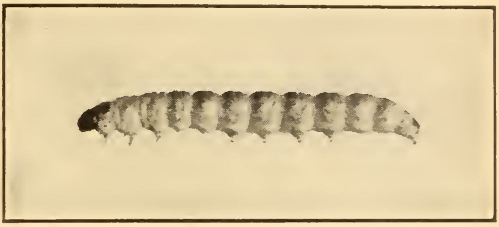

FIG. 14.—Side view of oriental peach moth larva. (× 3)

When a larva is ready to hatch it bites a hole in the eggshell, emerges, and immediately seeks food. Even though small, it is active and can crawl a considerable distance in a short time. It proceeds to enter the first desirable plant tissue found. It first spins a loose silken covering about itself, which probably gives it some support while gouging out pieces of the plant tissue. The first mouthfuls of tissue are set to one side unconsumed. The larva begins to feed when its head is deeply embedded in the plant tissue.

In summer the larval stage requires from 6 to 15 days, depending upon temperature, whereas cold weather in the fall prolongs this period considerably.

The larva of the peach twig borer (*Anarsia lineatella* Zell.), a common native pest, though not as yet serious in the Eastern States, is often found in twigs of peach trees, but can be distinguished from the larva of the oriental peach moth by its reddish-brown (chocolate) color.

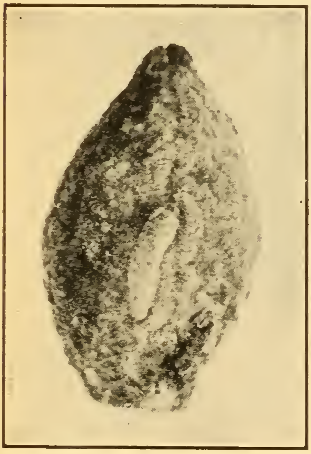

FIG. 15.—An overwintering cocoon of the oriental peach moth on an old dried peach. Natural size

THE COCOON

The cocoon (fig. 15) is a protective covering for the full-grown larva and pupa. After a larva completes its development in a twig or fruit it usually eats its way out, drops to the ground by means of a silken thread, or crawls down the tree, and seeks a place suitable for spinning a cocoon. Larvæ which drop to the ground, or come out of fallen fruit, spin their cocoons on, under, or within some object on the ground, whereas larvæ that crawl down the tree may spin their cocoons on some part of the tree. The cocoon is made of silken threads and particles of the objects on which it rests; these particles may be bark, peach pubescence, sand, leaves, or other material. Usually the cocoon is constructed in about 24 hours.

In the summer the cocoons are more fragile than the overwintering forms. The summer cocoons may be found on fruit, in axils of twigs, under pieces of bark, and in other situations. The more substantial overwintering cocoons are found in rough places on the tree, particularly in the crotches and under the rough bark on the trunk. If late varieties of peaches have been heavily infested, cocoons may occur in considerable numbers on the trunks of the trees, near the ground. Old quince trees with shaggy bark afford excellent hibernation quarters; frequently a dozen or more cocoons of the oriental peach moth may be bunched together under one piece of quince bark. Cocoons may also be found under flakes of apple-tree bark, when an infestation has occurred in the apples.

Cocoons are also found in places other than on the host plant. Trash of all kinds underneath infested fruit trees serves as hibernation quarters. Cocoons have been found on old dried peaches and quinces. After heavy infestations of quince trees some of the larvæ spin cocoons inside of the fruit, near the skin. Old, dried quinces in the spring sometimes have six or more protruding empty pupal shells after all the adults of the spring brood have emerged.

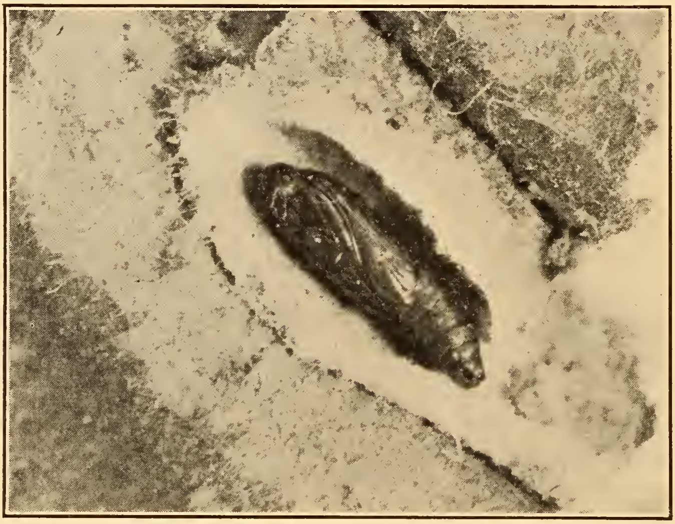

FIG. 16.—Cocoon of the oriental peach-moth opened to show pupa. (× 6)

THE PUPA

After the cocoon is completed the larva becomes quiescent, and gradually its body shortens and becomes thicker. This prepupal stage lasts for three to five days during the summer, after which the larva sheds its skin and a yellowish brown pupa (fig. 16), about one-fourth of an inch in length, emerges. The pupa gradually turns a darker red. Twenty-four to forty-eight hours before the adult emerges the wing cases of the pupa turn black, and a few hours previous to emergence the entire pupa becomes dark in color. At length the pupa pushes its way through the loosely spun end of the cocoon and the adult breaks the pupal shell near the cephalic end along the meson.

In the summer the duration of the cocoon, including the prepupal and the pupal stages, is from 12 to 15 days, the average duration being 14 days. In the spring this period is much longer. Late in the summer and early in the fall the question whether a larva will complete its development during the current season, changing to a pupa and emerging as an adult, may be determined by watching it for one week after it has spun a cocoon. If the larva does not change to a pupa within five to seven days it is an overwintering larva. This rule has held in all cases, within the limits of experience.

THE ADULT

The adult (fig. 17) is a small grayish-brown (fuscous) moth with a wing span approximating one-half inch. Males and females resemble each other closely. The female is usually a trifle the larger; this difference is especially noticeable in the case of the abdomen of the female when filled with eggs. The abdomen of a female is somewhat swollen, and a circular depression or area surrounded by a ring of scales occurs at the posterior end of the ventral side. The abdomen of a male is narrow, pointed at the end, and there is a slit-like mark at the posterior end on the ventral aspect.

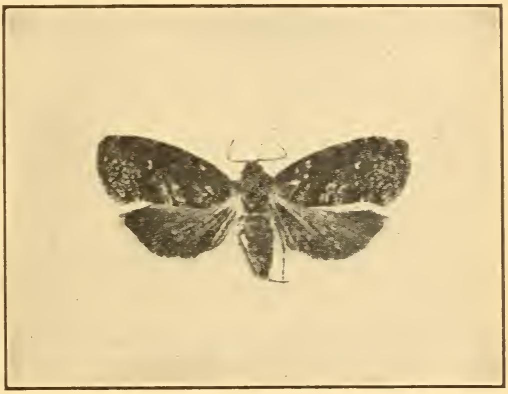

Fig. 17.—Dorsal view of oriental peach moth adult, with wings spread. (× 3)

Adult moths are most active about sundown. They have an irregular, up-and-down, or zigzag, flight. In the orchard they may be seen darting about the terminals, or new growth, of their host plants. Adults are occasionally very active in the middle of the day; this seems to be particularly true of the spring brood. The New Jersey records show that most of the adults in these midday flights are males. Adult moths live for 7 to 15 days in the summer, but in the spring and fall they may live much longer. Egg deposition usually begins 2 to 5 days after the females emerge and will continue for 7 to 10 days, or even longer. Unless the female is fertilized by a male few or no eggs will be deposited. The maximum number of eggs are deposited when the female has access to water or to sweetened bait.

Females deposit 100 to 200 eggs. In one series of trials 10 females were placed in each of 10 different glass jars, each 6 by 8 inches in size, with 5 to 10 males in each jar. The egg production per female ranged from 96 to 227, and averaged 148 for the entire lot.

Most eggs are deposited late in the afternoon, and deposition continues until an hour after sunset. On warm, cloudy days the eggs may be deposited earlier in the day. Some eggs may be deposited just before sunrise, if the temperature is near 70° F. or higher.

NUMBER OF GENERATIONS

The number of generations (complete or partial) per season has been found to be four in Connecticut and Pennsylvania, four or five in New Jersey, Maryland, and Virginia, and seven in Georgia. Table 3 shows the number of broods of moths, and the date of emergence of the first and last adults of each brood, for several localities in the Eastern States. In some of these (in New Jersey) there is a distinct overlapping of the emergence periods of all succeeding broods of moths. The writers are of the opinion that this overlapping probably occurs in most sections, if not in all. The relatively small number of individuals reared probably accounts for the distinct breaks between the adult emergence periods in most cases. To obtain overlapping it is necessary to rear about 1,000 or more individuals per generation.

TABLE 3.—*Number of broods of moths of the oriental peach moth, and dates of emergence of the first and last adults of each brood, for several localities in the Eastern States* [1]

Locality, investigators, and year of observation	Dates of emergence of first and last adults of each brood specified													
	Spring brood		First brood		Second brood		Third brood		Fourth brood		Fifth brood		Sixth brood	
	First	Last	First	Last	First	Last	First	Last	First	Last	First	Last	First	Last
Leesburg, Va. (Stearns, 1919)	Apr. 22	June 3	June 18	July 8	July 6	Aug. 10	Aug. 13	Aug. 29	----	----	----	----	----	----
Leesburg, Va. (Stearns, 1920)	May 1	June 7	June 19	July 12	July 11	Aug. 17	Aug. 15	Oct. 3	----	----	----	----	----	----
New Brunswick, N. J. (Peterson, 1924)	May 7	July 4	June 26	Aug. 7	Aug. 1	Oct. 1	Sept. 5	Oct. 19	----	----	----	----	----	----
New Brunswick, N. J. (Stearns, 1925)	Apr. 24	June 17	June 12	Aug. 5	July 15	Sept. 15	Aug. 22	Sept. 27	----	----	----	----	----	----
Riverton, N. J. (Peterson and Haeussler, 1925)	Apr. 13	June 19	June 5	July 27	July 8	Sept. 7	Aug. 9	Oct. 16	Sept. 7	Oct. 12	----	----	----	----
Fort Valley, Ga. (Snapp, Alden, and Swingle, 1925)	Mar. 8	Apr. 25	Apr. 28	May 28	May 29	June 25	June 26	July 28	July 20	Aug. 28	Aug. 17	Sept. 28	Sept. 16	Oct. 25
New Haven, Conn. (Garman, 1925)	May 5	June 11	June 27	July 23	July 28	Aug. 20	Sept. 1	Sept. 20	----	----	----	----	----	----
Chambersburg, Pa. (Stear, 1925)	(?)	(?)	June 13	July 13	July 13	Aug. 11	Aug. 17	Oct. 19	----	----	----	----	----	----
Arendtsville, Pa. (Frost, 1925)	Apr. 17	May 25	June 7	July 21	July 12	Aug. 23	Aug. 20	Sept. 30	----	----	----	----	----	----
Harrisburg, Pa. (Champlain and Kirk, 1925)	Apr. 13	May 28	June 19	July 6 to 12.	Aug. 4	Aug. 20	Aug. 17 to 20.	Oct. 5	----	----	----	----	----	----

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[1] The writers thank the investigators named for furnishing the information on the emergence of the adults in their localities.

TEMPERATURE

Temperature probably has a greater influence on the activity of the several stages in the life cycle of the oriental peach moth than any other environmental factor. All these stages are very resistant to changes in temperature, in that extremes apparently are not fatal but simply retard or accelerate activity.

The incubation period of the egg is greatly influenced by the existing temperature. There are records of incubation periods as short as 3½ days and as long as 43 days. The variations in the length of this period, as far as known, are entirely due to different temperatures at the time of incubation. Eggs hatch in 3½ days when the average temperature approximates 85° F., whereas temperatures near freezing greatly retard development and even prevent hatching.

Temperature also influences the development of the larva. A larva may mature in six days if the temperature in the daytime is near 95° to 100° F. Cold weather late in the fall may prolong the development to 90 days or even longer. One of the remarkable things about this insect is the fact that larvæ will continue to emerge from infested fruit (apples) until January. The fruit may be frozen solid several times, yet some larvæ will survive and emerge after the fruit thaws. Larvæ have been observed crawling slowly over fruit and jars when the temperature was at or slightly above freezing. Larvæ in cocoons are able to withstand temperatures as low as —10° F., and it is probable that they may withstand even lower temperatures.

Egg deposition is influenced by temperature. High temperatures, e. g., 80° to 90° F., seem to be most favorable for maximum egg production. Atmospheric temperature can be too high for maximum production, as was illustrated at Riverton on a few days in the season of 1925, when the temperature stood at more than 100° F. Low temperatures, e. g., 40° to 60° F., retard but do not for a prolonged period entirely prevent egg deposition. This information warrants the conclusion that the oriental peach moth will be able to withstand all temperature conditions occurring in regions where peaches are grown.

CONTROL MEASURES

The development of efficient control for the oriental peach moth is a difficult problem. The standard methods of insect control have not been found satisfactory; some of the reasons are considered in the following discussion.

Man's control measures for pests in an orchard fall into two groups—cultural practices and the use of chemicals. The chemicals may be subdivided into four groups: Stomach poisons, contact poisons, fumigants, and repellents. In controlling orchard pests, stomach poisons and contact poisons are used extensively as liquid sprays or dusts.

Control measures for this insect might be discussed from the viewpoint of cultural practices and insecticides, but in this publication the problem of control will be taken up from the viewpoint of the four stages in the life cycle of the insect—egg, larva (worm), cocoon (larva and pupa), and adult. Reference will be made to the cultural practices and the insecticides used.

CONTROL OF THE EGGS

Eggs can be killed by gases (fumigants) and contact poisons. The use of gases for this purpose under orchard conditions, however, seems to be precluded by the heavy concentration and prolonged exposure required. Destruction of the eggs by spraying with a contact poison can be made effective only at the cost of frequent and thorough applications throughout the season. There are three drawbacks to control by spraying: (1) Eggs of the oriental peach moth are present in orchards, especially peach orchards, at all times from blossoming until September or even October; (2) the incubation period is short, ranging in length from 3½ to 5 days in midsummer and from 6 to 10 days in the early and late portions of the season; (3) 99 per cent of the eggs in peach orchards are laid on the underside of the leaves, where they are hard to hit with a spray.

Nicotine sulphate, a contact poison, used at the rate of 1 part to 800 parts of spray or water, will kill 70 to 80 per cent of the eggs coated with this insecticide. L. A. Stearns, of the New Jersey Agricultural Experiment Station, has conducted extensive orchard tests with it. His experiments and those of other investigators show an increase of 8 to 13 per cent in the clean fruit when six applications are made at the rate of one-half pint of concentrated (40 per cent) nicotine in 50 gallons of spray. The average increase is approximately 10 per cent. The nicotine is used in the regular spray schedule as far as possible. These results indicate that by using nicotine sulphate a fruit grower may reduce a 50 per cent infestation to one of 40 per cent. The use of nicotine to kill the eggs is far from being a satisfactory control, yet it is the best spray known at present. The cost of including nicotine sulphate in the regular spray schedule and one or two additional sprays is high. However, Stearns's figures show that the increase in clean fruit pays the cost of the nicotine and nets a small profit.

CONTROL OF THE LARVÆ

Control of the oriental peach moth by dealing with the larvæ presents a difficult problem. The larvæ of many moths are killed by stomach poisons, usually arsenate of lead, dusted or sprayed on plant tissue consumed by the larvæ as food. It has already been explained that the larva of the oriental peach moth discards the first mouthfuls of plant tissue bitten out, and begins to feed when its head is deeply embedded. Therefore, before we can hope to kill this larva with a stomach poison some toxic substance must be found which it will consume. An ideal poison would be one which the larva prefers to its normal food.

Even if some suitable poison were known, its application would be a difficult matter. To prevent the larvæ from injuring the young twigs of peach trees the growing terminals would have to be kept covered. Because of their rapid growth early in the season, this would mean frequent applications. Ripening peaches could be protected from the larvæ only by maintaining a complete coating of the poison. The fruit might then be dangerous as food, should the poison be harmful to man, or discolored to such an extent as to impair its market value. Many larvæ enter the peach at the stem end, and the protection needed there would be next to impossible with the spraying and dusting appliances now used, especially in the case of peaches growing on short stems and close to the twigs.

The use of a contact poison to kill the larva is impractical because the larva spends most of its life within the twigs or fruit or in the cocoon. The only possibility along this line would be the development of a contact insecticide which would kill the larva or cause it to fall to the ground as it crawled over the material.

In Japan the fruit is protected by placing a paper bag about each peach. In Pennsylvania some of the quince growers bag the fruit. T. L. Guyton and A. B. Champlain report that successful control has been obtained in quince orchards in that State by similar treatment early in July. The bags apparently prevent the larvæ from reaching the fruit.

Many larvæ are found in dropped fruit, particularly in late peaches. The larvæ emerge and spin their cocoons somewhere near the fallen fruit. Probably picking up dropped fruit and burying it in a pit would reduce the overwintering population, but the importance of such a practice is unknown at present.

CONTROL OF THE COCOONS (LARVÆ OR PUPÆ)

The cocoon of the oriental peach moth serves as a protective covering for the full-grown larva and the pupa. No summer spray has been found which may be used against the larva or pupa in the fragile cocoon. Certain sprays and gases will kill the insect, but all are unsafe for growing plant tissue. The best time to use an insecticide for such a purpose would be during the season of dormancy. There are chemicals which will kill some of the larvæ in cocoons, but so far no satisfactory spray has been worked out. Most of the highly toxic products which will kill the overwintering larvæ are apt to produce injury to the dormant plant. Even though a satisfactory toxic agent for overwintering larvæ should be found it is exceedingly difficult to coat with a spray cocoons which are deeply concealed under pieces of bark and in other protected situations.

At times cocoons are fairly abundant near the ground on the trunks of late varieties of peach trees. The larvæ in these cocoons may be killed by the usual fall application of paradichlorobenzene recommended for the peach-tree borer.

It has been found that all larvæ in overwintering cocoons on the ground may be killed if covered with 4 inches of soil. Careful plowing and deep cultivation in the spring, before the adults begin to emerge, will bury the cocoons. This should be done one to three weeks previous to the blossoming period, when the larvæ in the cocoons have changed to pupæ. Pupæ will remain in the cocoons until the adult is ready to emerge; adults emerging from deeply buried pupæ are unable to reach the surface of the soil. It has been shown that larvæ may crawl for a short distance through loose soil, a fact which may make fall plowing less desirable than spring plowing and cultivation. There is, however, no evidence at present that fall plowing is less satisfactory than spring plowing.

Careful soil cultivation and the use of paradichlorobenzene will kill a goodly number of overwintering larvæ in a peach orchard, but the problem still remains of killing the larvæ in cocoons on other portions of the peach tree than those treated with paradichlorobenzene, and on the soil untouched by cultivation. In districts where tree fruits other than peaches are grown, suitable winter quarters may be found for the oriental peach moth. This is particularly true of old bearing quince orchards. Overwintering cocoons may also be found in apple orchards if the fruit was infested the previous season. The rough bark of quince and apple trees offers favorable locations for cocoons.

CONTROL OF THE ADULTS

If it were possible to kill the moths before eggs are deposited or to keep the females from laying, the problem of controlling the oriental peach moth would be solved.

Strong nicotine dusts will kill or stupefy the moths if properly applied, but the dustings must be frequent because of the daily appearance of new moths, and the high cost of this method has thus far been prohibitive. The females begin to deposit their eggs three to five days after they emerge from the pupa; the time is therefore very short when nicotine dusts or toxic gases can be effectively applied to the adult.

It has been shown that the growing shoots on nursery stock can be kept almost entirely free from larval attack, provided nicotine dust is used frequently and liberally (two or more times per week during the season). M. A. Blake, of New Brunswick, N. J., has had success with this method. It is probable that the nicotine dust prevents the adults from depositing eggs; and if eggs are deposited some may be killed by the nicotine in the dust.

Oriental peach moths are attracted to light but do not appear to be strongly phototropic to electric lights, particularly to the ordinary yellowish-white light. When given a choice between the ordinary yellowish-white electric light and the electric artificial daylight they select the artificial daylight. In a series of experiments at the laboratory where moths of both sexes were given an equal opportunity to select colored lights of approximately equal intensity they chose lights containing blue, violet, and ultraviolet rays. Few or no moths chose red, orange, or green. It appears that the adults will go to green or other colors if such colors contain some blue or violet rays.

In a peach orchard a few adults will come to the ordinary yellowish-white electric light. Wetherby, at Swedesboro, N. J., has installed in his peach orchard a large number of electric lights, 5 to 10 trees apart. Each light is about 3 feet above the ground and immediately above a large, round, shallow pan (18 inches in diameter and 4 inches deep) three-quarters full of water which is covered with a thin film of kerosene or some other oil. On most nights in June, July, and August the lights are in operation from sundown to midnight, or later. Large numbers of insects come to the lights and fall into the liquid in the pans, but comparatively few of them are oriental peach moths. The writers have not seen more than five adults of the oriental peach moth in any single pan in one week's collection. It is possible that the lights in this orchard would attract more adults if they were higher and near the tops of the trees; lights having a bluish tint might be more effective. All observations on the response of the moths to lights indicate that lights, by themselves, will not control the oriental peach moth.

BAITS

For three years baits have been used in fruit orchards to attract adults and determine the population present, but attractive baits have not been given a thorough trial as a possible means of control. Some of the interesting facts about the response of the moths to baits are here presented:

At times during the growing season large numbers of adults may come to fermenting baits. About 50 per cent of the adults caught with these baits are females; most of them have deposited few or none of their eggs. These facts are important in case a bait is found which may be used as a control. If enough gravid females, particularly adults of the spring brood, could be removed from the orchard, the infestation would be materially reduced.

Information at present shows that dilute (5 or 10 per cent) solutions of honey, refiner's sirup, corn sirup (mixed), brown sugar, table molasses, "blackstrap" molasses and other sugar-containing commercial products attract moths to a greater or less degree as soon as fermentation begins or some sort of a change takes place in the solutions after they have been in the orchard for a few days. The products are named, approximately, according to the order of their attractiveness. Dried prunes, apricots, pears, peaches, and apples, placed in bait containers in water, attract many adults as soon as they begin to ferment. Fermentation of sugar-containing substances and fruits produces an odor or odors which are attractive to males and females of the oriental peach moth but the exact nature of the attractive agent or agents is still unknown.

The addition of yeast to a bait seems unnecessary unless one wishes to hasten the process of fermentation. This may be desirable in the spring of the year when the outdoor temperature is low. Natural fermentation in warm weather usually begins within one to several days after the material is placed in the orchard. With some products the addition of yeast brings about a condition which makes the bait less attractive. Too rapid fermentation is undesirable because excessive foaming and scum formation results. These conditions reduce the number of moths caught. A surface free of solid or semisolid matter catches the largest number of adults.

A large number of essential oils and aromatic chemicals have been tried as attractive agents for the moth but so far no chemical has been found which is nearly so attractive as the products mentioned.

The number of moths caught varies considerably. Frequently the more attractive products catch 20 to 40 moths in each container per day when the adult population is high. The maximum catch for any one container for one day has been 128.

Bait containers located high in the tree catch more adults than those low in the tree if all other factors are the same. In large bearing peach trees 6 to 10 feet above ground seems to be the most desirable height. The most satisfactory bait container from the standpoints of catching the largest number of moths and of durability is an enameled stewpan with a wire bail and having a capacity of 3 to 4 pints. Some of the stewpans now in use have been in the orchards for three seasons and appear to be good for another. Tin and aluminum containers are much less durable and fermenting baits, at least in tin containers, do not catch as many adults as when placed in enameled ware. Wide-mouth glass quart jars are fairly satisfactory when placed high in the tree. They catch more adults than 1-quart or 3-quart tin containers but not so many as the enameled stewpans.

The use of a bait for controlling the oriental peach moth is still in the experimental stage, and no recommendations can as yet be made. The information presented here will suggest to the grower and others interested in the problem one line of investigation now being pursued.

NATURAL CONTROL

PARASITES

The oriental peach moth is beset by so many parasites that in their use seems to lie the strongest hope of successful control. At present 15 or more species of parasites are known to attack the several stages in the life cycle of the insect. It has been repeatedly noted that in a new territory the infestation of the oriental peach moth is usually most severe in the second and third years after it becomes established. As a rule, after the third year the extent of damage per season varies considerably; in some seasons no commercial injury occurs, whereas in other seasons the injury may be moderate to heavy. The seasonal reduction and variation in injury in a long infested area are in large measure due to the work of parasites.

A good example of what parasites can do was noted in the season of 1925 in the peach district about Riverton, N. J. The emergence of adults from overwintering pupæ and from the pupæ of the first brood was large, and all indications pointed to severe injury to the fruit. Large numbers of injured twigs were observed on young trees late in June and early in July, after the larvæ of the second brood were hatched, and consequently an exceedingly large number of adults of the second brood was expected in July. Instead, the second brood of adults was very small, as shown by the number caught in bait pans. This reduction in number was largely the work of one species of parasite, *Macrocentrus* sp. Collections of larvæ taken from twigs late in June and during July showed parasitism running as high as 88 to 100 per cent. This parasitism reduced the fruit infestation in Elbertas to 5 or 10 per cent, whereas in previous seasons Elberta peaches in the vicinity Riverton suffered 35 to 50 per cent infestation.

Late in the season a common egg parasite, *Trichogramma minutum* Riley, was present about Riverton in considerable numbers, the parasitism being 60 per cent and higher. As time goes on other parasites will be found and important species may be introduced. It is believed that in the future parasites will play an important part in the control, or the material reduction, of the present ravages of this insect. In the meantime investigational work will be pushed in the hope of obtaining some control measure which will relieve the present situation in heavily infested districts.

FUNGOUS DISEASES

For several years it has been observed that many overwintering larvæ in cocoons are killed by fungi. The most common of these is a white mold of unknown species, characterized by small, translucent, round spores. Larvæ in cocoons on the tree, near or actually on the ground, are most apt to be killed by fungi.

DEAD LARVÆ IN TWIGS

Dead larvæ of the oriental peach moth, usually surrounded by sap, are frequently found in peach twigs. It has been repeatedly observed that after a rainy period, more especially one preceded by a drought, injured twigs have an excessive flow of sap. This forces the larvæ to crawl outside if escape is possible; those unable to escape may be drowned in the sap. Dead larvæ are seldom present in the twigs in dry periods. From these considerations it is believed that the cause of death is drowning, and this belief is supported by the general appearance of the dead larvæ. However, since fungous and bacterial organisms are usually most abundant in wet spells, it is possible that they are the cause of death.

SUMMARY

The oriental peach moth, scientifically known as *Laspeyresia molesta* Busck, is a new and serious pest of peaches, quinces, and other fruits. It attacks chiefly young growing twigs and ripening fruit.

Its native home is not known. It has been found in several countries, and is supposed to have been introduced into the United States from Japan about 1913. It now infests an area which includes most of the peach-producing centers in the eastern part of the United States and Canada. There are four stages in the life cycle of the insect—the egg, the larva, the pupa, and the adult. The larva (worm) is the destructive stage. The insect passes the winter as a full grown larva in a silken cocoon. Cocoons may be found on the host plant or on the ground. Adults (moths) begin to emerge when peaches are in blossom, and may be present in the orchard during the entire growing season. Thus far in the infested districts four to seven broods have been recorded for one season. In some sections of the infested area there is considerable overlapping of successive broods. During the summer the life cycle, egg to adult, requires about 30 days—eggs 3½ to 6 days, larvæ 6 to 15, and the cocoon stage, including the prepupal and pupal stages, 12 to 15 days. The adults live 7 to 15 days, or longer.

As yet no one cultural practice or insecticide has been found which will control this insect. Some of the eggs may be killed with nicotine sulphate sprays, but this remedy is far from satisfactory. No stomach or contact poison has been found which will control the larvæ in the orchard when applied as a dust or spray.

Larvæ and pupæ in cocoons on the ground may be killed by plowing or cultivating in the spring to a depth of 4 inches. This should be done one to three weeks previous to the blossoming period of peaches. Larvæ in cocoons on the trunks of peach trees near the ground may be killed in the fall by an application of paradichlorobenzene.

The moths are to some extent attracted to lights possessing blue to violet rays. The adults come in large numbers to fermenting baits composed of sugar-containing products or fruits. The use of baits as a means of control is still in the experimental stage.

In recent years and in certain Eastern States, especially in portions of New Jersey, Pennsylvania, and Maryland, late peaches have suffered infestations running as high as 75 to 100 per cent. Serious infestations have not occurred in the peach-growing regions of the Southeastern States.

The larvæ attack tender, growing twigs, especially of peaches, but also of the plum and the cherry, and to some extent of the quince. When newly hatched a larva, as a rule, enters the tender growing twig at its tip, near the base of a young leaf; a half-grown larva may enter at the axil of a new, fully developed leaf. The twigs so injured are more or less wilted, and the tree sometimes seems stunted in growth, but fruit growers do not usually regard the injury as serious.

Fruit, mainly quinces and peaches, is heavily infested by the larvæ, quinces having the heaviest infestation recorded. Late-ripening peaches are often heavily infested, but early varieties usually escape serious injury. Weather conditions have some influence on extent of infestation, as does also the quantity of fruit on the tree concerned.

Injury to fruit, according to the point of entrance of the larva, is classified into three kinds, namely, "side entrance," "stem entrance," and "invisible entrance." "Side entrance" is largely caused by partly grown larvæ which have abandoned twigs and gone to the fruit. "Stem entrance" is largely caused by newly hatched larvæ which enter the fruit through the tender tissue surrounding the stem, while "invisible entrance" is entirely due to newly hatched larvæ which enter the fruit through the stem itself.

The oriental peach moth and the codling moth resemble each other in many respects.

Many parasites attack the oriental peach moth, and the strongest hope of successful control seems to lie in their use. At present 15 or more species of parasites are known to attack this insect in one or another of its stages, and it is hoped that others will be found.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

October 4, 1926

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